

Radiology Compliance Branch

RADIATION PROTECTION SECTION



Division of Health Service Regulation • N.C. Department of Health and Human Services

The Basics of Understanding Radiation Protection

What is the primary goal?

To deliver optimal animal and human healthcare, while providing exemplary radiographic images at the lowest radiation dose possible. This goal also incorporates the safety of the general public and occupational worker. Radiological benefits to medicine are undisputed; however, they must always be weighed against the potential dangers that overexposure present. The benefit **must** outweigh the risk!

How do we, as radiation workers, accomplish this goal?

Education

- Use the Division of Environmental Health's Radiation Protection Section's Assessment Tool to grade the facility's written radiation safety program.
- Conduct an annual review of the written safety program.
- Continue education that incorporates radiation safety and protection.
- Become registered or certified by the appropriate professional entity for your practice.

Know the Importance of Radiation Physics and Radiation Biology

- There are natural and artificial sources of radiation.
- Artificial sources are common and include high energy forms of electromagnetic radiation; i.e., radio waves, microwaves, infrared rays, visible light, ultraviolet rays, X-rays and gamma rays.
- X-rays and gamma rays have the ability to ionize matter because they have the highest energies.
- When radiation interacts at the atomic or molecular level, change can and will occur.
- If a cellular change occurs, it can affect the cell's normal function and viability.
- Cells are the basic unit of life, and each cell has a specific function to support the body.
- Reproductive and blood cells are among the most sensitive cells to radiation.
- If a cell is damaged beyond repair by radiation, it will function abnormally or it will die.



- When DNA, which is located in the cell, is damaged by radiation, it can become altered. This can and will produce genetic side effects.
- It is important to also remember that a growing fetus is most susceptible to embryologic effects from radiation during the first trimester.
- The severity of any effect is directly related to the amount of radiation received.

Radiation Protection Strategies that Minimize Exposure and Decrease Dose

- It is important to remember that there is no safe level of radiation dose.
- Damages from radiation increase proportionally as the dose levels increase; therefore, **all** exposures carry a risk of damage to a biological system
- Keep the exposure **As Low As Reasonably Achievable**.
- Implementing **ALARA** because any amount of unnecessary medical radiation is too much.
- Use the lowest level of exposure possible while still providing the highest quality image. This also includes using the least amount of time possible to expose the patient.
- Remember that pediatric patients are more at risk due to the fact that their cells are rapidly dividing while growth is occurring.
- Time, distance and shielding. Decrease the exposure time, and increase the operator's distance from the source.
- Use appropriate shielding that does not interfere with the exam. Finally, use appropriate shielding when performing exams where, you as the occupational worker, may be exposed

Table A. 1

The Inverse Square Law states that as the distance between the radiation source and a measurement point increases, the quantity of radiation measured at that point decreases by the square of its distance from the source. In other words, more distance equals less intensity and dose!

DISTANCE

INTENSITY

| | | |
|---------------|----------------------|----------------------------------------|
| More Distance | <i>EQUALS</i> | Less Intensity (quantity of radiation) |
| 2 X Distance | <i>EQUALS</i> | 1/4 Intensity |
| 3 X Distance | <i>EQUALS</i> | 1/9 Intensity |
| 4 X Distance | <i>EQUALS</i> | 1/16 Intensity |

As a radiation equipment operator, you are professionally and ethically obligated to protect you, your patients, co-workers and the public. This requires that you always

remember that radiation is cumulative over one's lifetime. *"It is your's to keep, once acquired!"* Some of the best and most effective dose-limiting strategies are easy and fairly simple to implement. When a facility is not in compliance, it is usually due to how the facility is practicing with radiation. Finally, education of the facility's workers, patients and the public still remains the most important aspect of **radiation protection**.

Basic Radiation Principles to Follow to Operate Safely

- The operator should remain behind the protective barrier or wall. Always protect yourself as an operator when mobile exams are being done as well.
- Use the external or internal technique charts. **Never, never, never** guess at a technique. Employ pediatric techniques in all modalities.
- Shield the parts of the patient that is not of interest.
- Never hold patients or allow family members to hold patients when you or they are not wearing protective equipment. This would include lead aprons, thyroid shields and gloves.
- Never turn your back to the radiation beam when only the front portion of your body is covered by the lead apron.
- Be sure to train all the operators either by official documented training done by a knowledgeable individual in your facility or by registration/certification.
- Collimate properly — decrease the light field to only the part of interest.
- Use matching screen film combinations.
- Shield patients not being examined that can be removed from the room. This would incorporate the use of mobile exams and stationary exams.
- Close necessary doors before exposures are made.
- Incorporate a pregnancy screening policy and forms to document that there is no chance of pregnancy. Remember, documentation is the key!
- Maintain complete control of any areas where the general public may be located. This would mean making sure that no individual could get into an area where exposures are being made. As an operator, you have to maintain complete control of all accesses. This also includes vocalizing the fact that you are taking an X-ray to make sure anyone around knows what is happening.
- Wear personnel monitoring devices that are appropriate for your facility. The device should indicate what part of the body on which it should be placed. Read the badge reports and be knowledgeable about your lifetime dose.